U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-318/89-15

Docket Nos. 50-318

License No. DPR-69

Licensee: Baltimore Gas and Electric Company
Charles Center
P. O. Box 1475
Baltimore, Maryland 21203

Facility Name: Calvert Cliffs Nuclear Power Plant Unit 2

Inspection At: Lusby, Maryland

Inspection Dates: May 8- 12, 1989

Inspector: R. W. Winters, Reactor Engineer, MPS, EB, DRS, Region I — 6/8/89 date

Approved by: S. Chaudhary, Chief, Materials & Processes Section, Engineering Branch, DRS, RI — 6/8/89 date

Inspection Summary: Routine unannounced inspection on May 8-12, 1989 Report No. 50-318/89-15)

Areas Inspected: The inservice inspection program, including the ten year plan, steam generator eddy current testing, primary and secondary water chemistry results, and the erosion corrosion control program was reviewed.

Results: One violation concerning the certification of the licensee's nondestructive examination personnel was identified. No other deviations or violations were found in the areas inspected.

DETAILS

1.0 Persons Contacted

Baltimore Gas and Electric Company

H. Brust, Nuclear Materials Engineering
S. Buxbaum, Supervisor, Nondestructive Examination
P. Callanan, Quality Assurance Auditor
* P. Crinigan, General Supervisor, Chemistry
* C. Cruse, Manager, Nuclear Engineering
L. Decker, Nuclear Materials Engineering
* K. Hoffman, Nuclear Materials Engineering
* W. Lippold, General Supervisor, Technical Services Engineering
* A. Reed, Engineer, Metals Laboratory
L. Russell, Manager Calvert Cliffs
* B. Rudell, Supervisor, Nuclear Materials Engineering
* D. Shaw, Licensing Engineer
* D. Van Petten, Nuclear Materials Engineering

Zetec Incorporated

W. Gray, Supervisor, Eddy Current Testing

NDE Technologies Corporation

T. Beiers, Lead Engineer, Eddy Current Evaluation

United States Nuclear Regulatory Commission

* V. Pritchett, Resident Inspector

* Denotes those attending the exit meeting.

The inspector also contacted other administrative and technical personnel during the inspection.

2.0 Scope

The scope of this inspection was the review and observation of activities in the following areas:

-- steam generator eddy current examination

-- the ten year inservice inspection (ISI) program

-- the erosion corrosion control program

-- NDE examiner certification program

-- primary and secondary water chemistry results

3.0 Steam Generator Eddy Current Examination Review

Eddy Current Examination

The ISI of the steam generator tubes is conducted in accordance with the unit's Technical Specifications. It is not part of the ISI program for the balance of plant equipment and components. In accordance with the Technical Specifications the minimum number of tubes required for the inspection was 6% of the active tubes in either steam generator. This amounted to 508 tubes in steam generator 21 or 510 tubes in steam generator 22.

The licensee, however, opted to perform a 100% inspection of the 8456 active tubes in steam generator 21 and of the 8491 active tubes in steam generator 22 using the standard bobbin coil EC technique.

As a result of this examination, six defective and five degraded tubes were identified in steam generator 21, and five defective and three degraded tubes were identified in steam generator 22. These tubes were scheduled for plugging. These defective and degraded tubes placed the steam generators in Category C-2. Category C-2 is defined as follows:

> One or more tubes, but not more than 1% of the total tubes inspected are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.

Of the six tubes found defective in steam generator 21, all were suspected intergranular attack in the sludge pile region. Of the five defective tubes in steam generator 22 two were suspected wear at the vertical middle support plate (antivibration bar) and three were suspected intergranular attack in the sludge pile region.

In addition to the above testing, the licensee elected to perform motorized rotating pancake coil (MRPC) inspections of selected tubes in each of the steam generators. This technique was used both in the U-bend region and from the first support plate into the tubesheet. The NRC inspector observed selection of the tubes to determine if primary side intergranular cracking was present at the top of the tubesheet as reported by another licensee. These tubes were selected based on areas in the steam generator that indicated active areas of degradation, i.e. areas of previously plugged tubes due to IGA at the top of the tubesheet. The inspector also observed the testing of selected tubes using the MRPC.

Data Analysis

The inspector observed the analysis of the eddy current data and interviewed the Level III analysts of the responsible organizations to

determine the adequacy of the method. The eddy current data were analyzed using a three step process as follows:

-- Primary analysis by individuals certified as at least a Level II analyst in eddy current testing.

-- A screening of the data by computer using more stringent acceptance standards than those used by the primary analyst.

-- Secondary manual analysis by individuals certified as, at least a Level II analyst in eddy current testing. The secondary analysis was performed by a company independent of the company retained for data acquisition and primary analysis.

Following these analyses, resolution of differences was accomplished by a certified Level III analyst in eddy current examination.

Conclusions

Based on the inspector's review of the steam generator eddy current testing program and observation of the testing and data analysis, the inspector concluded that the licensee had performed testing and evaluation in excess of the Technical Specification requirements. Nineteen of the 9336 active tubes were plugged (8 as a preventive measure). Use of the MRPC in the U-bend regions and from the first support plate into the tubesheet indicate the licensee's concerns for defects found by other facilities.

4.0 Erosion/Corrosion Control Program

The licensee initiated an informal erosion/corrosion (E/C) program in 1979 to identify carbon steel systems where E/C existed, quantify the extent of E/C, and to establish a decision making process for inspecting or replacing components. The present formal program was established in 1984.

The program is administered by the licensee's ISI group. These engineers have classified various components in accordance with a priority system based on steam moisture content or flashing conditions within the system and fluid velocity, component geometry, operating conditions, temperature/pressure, and plant and industry experience. The total number of components in all three priorities ('A', 'B', or 'C') is approximately 3000 in Unit 2. During normal outages approximately 250 components are inspected. Of these 250 components, approximately 40% are reinspections of components previously identified as "Red Alert". A four step system is used to classify inspected components as follows:

-- Unacceptable - these components have reached minimum wall thickness or it is expected that they will reach minimum wall

thickness during the next refueling cycle. Unacceptable components are replaced except when detailed engineering evaluation indicates that they will not reach minimum wall thickness during the next operating cycle.

-- Red Alert - it is predicted that these components will last for one refueling outage and will need to be replaced during the next outage. Red alert components are scheduled for replacement during the next refueling outage. However, prior to replacement they are reinspected and a detailed evaluation prepared by engineering.

-- Yellow Alert - it is predicted that these components will last for two refueling outages before requiring replacement. Yellow alert components are scheduled for reinspection during the second outage after falling into the Yellow alert category.

-- Acceptable - it is predicted that these components will not require replacement until the third outage as a minimum. The condition of these components is recorded and inspection rescheduled as required.

The licensee experienced a leak in the blowdown line from steam generator 22. The inspector noted that this blowdown line was in the E/C program where several areas had been inspected and identified as having wall loss significantly less than that of the failed piping. The leak location was scheduled for inspection during the current outage. The actual failure was at an area of acceptable undercut on the pipe adjacent to the socket weld of the elbow. This undercut was located in the area of most severe/erosion. A leak occurred when the erosion met the undercut.

Conclusions

The licensee's program for E/C is comprehensive and has been in operation long enough to provide meaningful data on the characteristics of the plant components. The failure of the program to identify the steam generator blowdown line was traced to a welding defect, not to a breakdown in the E/C program. This particular section of piping was scheduled for examination during the present outage and presumably, this thin section in the piping would have been identified and replaced. Additional information regarding this steam leak is covered in NRC IR No. 50-318/89-14.

5.0 Inservice Inspection Program Review

Calvert Cliffs Units 1 and 2 are in the first period of the second 10 year inspection interval at this time. The ISI program is based on the ASME Code, Section XI, 1983 Edition, Summer 1983 Addenda. The

initial interval was adjusted so that the ISI program for each unit would be coincident. This adjustment was approved by the NRC.

The inspector discussed the ISI program with the responsible engineer and determined that the required inspections for the first period of the second interval had been completed except for those components that were dependent on other plant activities being completed, e.g. the fuel moves being completed.

6.0 NDE Examiner Certification Program

In addition to the licensee's staff, contractors are used for various types of NDE associated with ASME Section XI, the E/C program and steam generator eddy current inspections. The licensee's staff was technically capable of performing their assigned duties, and the staff size appeared adequate to meet the scheduled work load. The inspector selected staff NDE personnel qualification - certification records, and records related to contractor NDE personnel. The records of contractor personnel who had performed examinations at the site were reviewed and it was verified that these individuals were properly qualified and certified in accordance with the applicable requirements of ASME Section XI and SNT-TC-1A. The inspector reviewed the qualifications - certifications for a representative sample of the individuals involved in the data analysis of the testing done on the steam generators. These individuals were highly qualified and properly certified.

Licensee personnel were certified in the visual, liquid penetrant, magnetic particle, and ultrasonic examination methods. Records of selected individuals reviewed by the inspector to determine that their certifications was in accordance with the requirements of ASME Section XI, ANSI N45.5.6 - 1978, SNT-TC-1A, and the licensee's program. The record packages were found to contain documentation of current visual acuity, education, resumes, and various training records. However, these records did not clearly show that the qualification, experience, and training requirements were met prior to certification. Also, the records did not indicate that the requirements for visual examiner types VT-1, VT-2, VT-3 and VT-4 had been addressed. The licensee's written program for certification did not address these visual requirements. In addition, the annual training requirements of the licensee's program had not been met. The inspector noted that in one case the certification for a visual examiner had expired. The inspector discussed this with the individual and was informed that the individual was not aware of his certification having expired since the licensee had discontinued the procedurally required practice of issuing NDE examiner identification cards. The licensee issued a nonconformance report to require investigation of the inspections performed by this individual during the period his certification was expired. These deficiencies are a violation of 10 CFR 50, Appendix B,

Criterion IX, and the licensee's written procedure requiring compliance to the ASME Code and SNT-TC-1A (89-15-01).

Conclusions

The licensee maintains acceptable control of their NDE contractors and their certifications. However, certification records of the licensee's staff were found incomplete and lacking in organization.

7.0 Primary and Secondary Water Chemistry

Water chemistry data were reviewed as part of this inspection. The methods of collecting and verifying the accuracy of these data were not included in the scope of the inspection.

The inspector reviewed the primary water chemistry results for the period from January, 1988 through March 1989 and observed that the Boron/Lithium ratio was significantly above the licensee's specification (CP-204) for 8 of the 14 months of full power operation. This ratio is varied to maintain the pH in the required range of 6.8-7.5. During this period the pH was maintained within specification except for short periods of time. The Iodine Dose Equivalent was maintained at less than 0.1 uCi/gm which is significantly below the Technical Specification limit of 5.0 uCi/gm.

In reviewing the secondary water chemistry results for the three months preceding the shutdown for the present refueling outage the inspector observed that the licensee was achieving water quality results superior to the EPRI Guidelines. Typical results for this period are shown in Table 1.

TABLE 1

Secondary Water Chemistry History

Blowdown Sample

Parameter	Calvert Cliffs Results	EPRI Guide
Cation Cond., uS/cm	0.11	0.8
Chloride, ppb	2	20
Sodium, ppb	5	20
Sulfate, ppb	2	

8.0 Pressurizer Heaters

The licensee reported that 22 of the 120 heater assemblies in the pressurizer in Unit 2 showed evidence of leakage. This evidence was

indicated by boron buildup on the outside of the heater assembly. The assemblies consist of an inconel sleeve 1.158 inch O.D. and approximately 0.875 inch I.D. welded into the bottom head of the pressurizer on the inside with a partial penetration fillet weld. The heater assembly is welded to the outside of the sleeve to provide a removable seal for heater replacement. Heaters showing evidence of leakage are identified as shown in Table 2.

TABLE 2

HEATER LOCATIONS SHOWING EVIDENCE OF LEAKAGE

H3	F3	D3	E2	M2	C2	C1	H1	F2	D2	B2
A1	B1	D1	F1	K1	J2	G2	E1	G1	Z1	BB1

In addition to the evidence of leakage found around the above heater penetrations, other evidence of leakage was observed near the top of the pressurizer at the pressure tap located 7 1/2^{o} from 0^{o} toward 90^{o}.

At the time of the inspection the pressurizer had not been opened to allow internal examination of these areas.

Failure Analysis

The inspector discussed the heater leaks with one of the plant metallurgists and was informed that the licensee had provided samples to the mobile metallurgical laboratory installed in a van to perform analysis of these and other failures as required. The inspector toured this facility and noted that it contained all of the equipment necessary for performing metallographic analysis including high and low power optical microscopes with photographic capability, metallographic sample preparation facilities, and a data link with the main laboratory. This facility allows the licensee to perform controlled and timely failure analysis.

9.0 Management Meetings

Licensee management was informed of the scope and purpose of the inspection at the entrance interview on May 8, 1989. The findings of the inspection were discussed with licensee representatives during the course of the inspection and presented to licensee management at the May 12, 1989 exit interview (see paragraph 1 for attendees).

At no time during the inspection was written material provided to the licensee by the inspector. The licensee did not indicate that proprietary information was involved within the scope of this inspection.